

Amendments to the Claims

Please amend the claims as follows:

1. (Currently Amended) A computer comprising one or more computer-readable media and a processor, the computer-readable media containing instructions, which, when executed by the processor on the computer, cause the computer to perform the actions of a system for detecting a data race in a multithreaded concurrent program, the system comprising:

a program sequentializer module configured to ~~accept~~ receive code for a concurrent program as input and create as output a single-threaded sequential program utilizing a single run-time stack having assertions;

wherein, when the sequential program is analyzed by a program analyzer, the assertions cause an error message to be produced by the program analyzer when the concurrent program contains a data race;

wherein the program sequentializer module is further configured to add data structures to the received code, the added data structures at least comprising:

a multiset of thread pointers which comprises pointers to threads which have been created but have not yet been scheduled on the runtime stack; and

a global boolean exception variable which, when set, causes the single-threaded sequential program to remove from the runtime stack the currently-executing thread.

2. (Currently Amended) The computer of claim 1, wherein the system further comprises a sequential program analyzer module which analyzes the single-threaded sequential program and produces error messages if assertions are not met and wherein the assertions are created to be checked by the sequential program analyzer.

3. (Canceled)

4. (Currently Amended) The computer of claim 3 1, wherein:
the multiset of thread pointers is limited to a maximum number of pointers; and
the added data structures further comprise a global multiset size variable, which indicates the maximum number of pointers.

5. (Currently Amended) The computer of claim 3 1, wherein:
the program sequentializer module is further configured to receive an indication of a target variable which will be analyzed for data races; and
the added data structures further comprise a global access variable which indicates, for the analyzed target variable, the current type of access being requested of the analyzed target variable.

6. (Previously presented) The computer of claim 5, wherein the program sequentializer module is further configured to insert instrumentation into the received code, the instrumentation at least comprising:

- a scheduling function which selects a thread pointer from the multiset and schedules the thread indicated by the pointer on the runtime stack;

- an exception macro which sets the global boolean exception variable and causes an executing thread to be removed from the runtime stack;

- a read-checking function, which checks to see that the global access variable does not indicate that the target variable is being written to and then sets the global access variable to indicate that the target variable is being read from; and

- a write-checking function, which checks to see that the global access variable does not indicate that the target variable is being read from or written to and then sets the global access variable to indicate that the target variable is being written to.

7. (Previously presented) The computer of claim 6, wherein the read-checking and write-checking functions contain assertions about the global access variable which can be checked by the sequential program analyzer module.

8. (Currently Amended) The computer of claim 6, wherein the instrumentation is inserted so that it will execute nondeterministically in the single-threaded sequential program.

9. (Currently Amended) The computer of claim 1, wherein the single-threaded sequential program output by the sequentializer module is in the form of source code.

10. (Currently Amended) The computer of claim 1, wherein the single-threaded sequential program output by the sequentializer module is in the form of an abstract syntax tree or a control-flow graph.

11. (Currently Amended) The computer of claim 1, wherein the code for the concurrent program received by the sequential analyzer is in the form of source code.

12. (Currently Amended) The computer of claim 1, wherein the code for the concurrent program received by the sequential analyzer is in the form of an abstract syntax tree or control-flow graph.

13. (Currently Amended) A method of analyzing a concurrent program for data races, the method comprising:

receiving a concurrent program;

receiving at least one target variable to be analyzed for data races; and

creating a single-threaded sequential program utilizing a single runtime stack from the concurrent program, the single-threaded sequential program containing assertions such that, during an analysis of the sequential program, when the assertions are not met, the analysis of the sequential program indicates the presence of a data race in the concurrent program for the target variable;

wherein creating a single-threaded sequential program comprises adding instrumentation and variables to the concurrent program which cause the functions of the concurrent program to be executed sequentially; and

the added variables include:

a multiset of thread pointers which comprises pointers to threads which have been

started but have not yet been scheduled on the runtime stack of the sequential program; and
a global boolean exception variable which, when set, causes the sequential program to
remove from the runtime stack the currently scheduled thread.

14. (Currently Amended) The method of claim 13, wherein:

~~creating a sequential program comprises adding instrumentation and variables to the concurrent~~
~~program which cause the functions of the concurrent program to be executed sequentially; and~~

the added variables include:

~~a multiset of thread pointers which comprises pointers to threads which have been started but~~
~~have not yet been scheduled on the runtime stack of the sequential program; and~~

~~a global boolean exception variable which, when set, causes the sequential program to remove~~
~~from the runtime stack the currently scheduled thread; and~~

a global access variable which denotes, for the analyzed variable, the current type of access
being requested of the variable.

15. (Currently Amended) The method of claim 14, wherein the added instrumentation
includes:

a scheduling function which selects a thread pointer from the multiset and schedules it on the
single runtime stack;

an exception macro which sets the global boolean exception variable and causes an executing
thread to be removed from the single runtime stack;

a read-checking function, which checks to see that the global access variable does not indicate
that the target variable is being written to and then sets the global access variable to indicate that the
target variable is being read from; and

a write-checking function, which checks to see that the global access variable does not indicate
that the target variable is being read from or written to and then sets the global access variable to
indicate that the target variable is being written to.

16. (Original) The method of claim 15, wherein the read-checking and write-checking functions contain assertions about the global access variable which can be checked by a sequential program analyzer.

17. (Currently Amended) The method of claim 15, wherein the instrumentation is inserted so that it will execute nondeterministically in the single-threaded sequential program.

18. (Currently Amended) A computer-readable storage medium containing instructions which, when executed, ~~check~~ cause a computer to perform a method of checking a concurrent program for one or more violations of assertions, ~~the instructions configured to~~ method comprising:

~~receive~~ receiving a concurrent program; and

~~create~~ creating a single-threaded sequential program utilizing a single runtime stack from the concurrent program at least in part by adding instrumentation and variables which cause the functions of the concurrent program to be executed sequentially, the sequential program containing assertions such that, during an analysis of the sequential program, when the assertions are not met, the analysis of the sequential program indicates the presence of an error in the concurrent program

wherein the added variables include:

a multiset of thread pointers which comprises pointers to threads which have been started but have not yet been scheduled on the runtime stack of the sequential program; and

a global boolean exception variable which, when set, causes the sequential program to remove from the runtime stack the currently scheduled thread.

19. (Canceled)

20. (Previously presented) The computer-readable storage medium of claim ~~19~~ 18, wherein the added instrumentation further includes:

a scheduling function which selects a function pointer from the multiset and schedules it on the runtime stack; and

an exception macro which sets the global boolean exception variable and causes an executing thread to be removed from the runtime stack.